

SDMS Document



112853

ARCADIS GERAGHTY & MILLER



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Dear Mr. Quadri:

ENVIRONMENTAL

ARCADIS Geraghty & Miller has reviewed the proposed groundwater PRAP for the Ruco site and on behalf of the Northrop Grumman Corporation offer the following comments:

1. Northrop Grumman Corporation (NGC) is opposed to any remedial approach that does not intercept and treat the Vinyl Chloride Monomer (VCM) subplume before it affects the downgradient NGC treatment plant.
2. The alternative remedy proposed, should biosparging be shown not to be effective, is pump and treat. If a pump and treat system is needed, it should be designed so that it does not interfere with the goals of the downgradient NGC pump and treat system.
3. Based on a review of the pre-design data collected by Conestoga Rover Associates (CRA), the subsurface environment at the Ruco site and immediately downgradient is anaerobic and reducing. Biosparging, by its very nature will disrupt the anaerobic and reducing environment that exists at and off-site (south and southeast) of the Ruco site. The subsurface environment upgradient of the Ruco source area is primarily oxidizing; downgradient of the impacted zone the natural environment reasserts itself with a transitional change to a somewhat oxidizing environment. The biosparging process proposed will disrupt the natural degradation of the source derived chlorinated compounds, i.e., trichloroethene (TCE) and tetrachloroethene (PCE). It is likely that where oxygen is supplied the anaerobic conditions will be disrupted. This will contribute to an increase in the flux of Ruco site-related PCE and TCE downgradient of the source area. Except for the TCE, PCE and dichloroethene (DCE) that is stripped during the biosparge process, there will be no additional remediation of these compounds via the biosparge system. Therefore, the NGC treatment system will have to treat these compounds from the Ruco property and the previously anaerobic off-site area. An evaluation must be made to assess the impact that the disruption of the anaerobic biodegradation zone and the resulting flux of TCE and PCE would have on the downgradient NGC treatment plant.

Melville,
28 August 2000

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4. Biosparging downgradient of the source area – in the transitional and aerobic environments where VCM persists, but the aerobically degradable compounds, like ketones and alcohols, are depleted – should enhance the degradation of VCM.
5. The following practical issue concerning the application of biosparging must be addressed:
 - It will be necessary to sparge at extreme depth (greater than 350 feet bls in the downgradient area, where primarily VCM is present). This means that air will have to be forced at pressures in excess of 180 psi to overcome the head exerted by the approximately 320 feet of water column. Thus all the wellhead assemblies must be constructed in accordance with ASME code requirements for similar pressures. Flanges, fittings, and piping must be properly selected and designed for these conditions. This includes the pilot test wells and equipment, as well as the full-scale system components. Wellhead retrofits may be required at existing wellheads and proper health and safety precautions should be adhered to, particularly where public access cannot be controlled.
6. There are several process issues that are also critical and may, in fact, preclude the use of biosparging under the site conditions as follows:
 - Because of the high pressure at which the system must operate to successfully sparge to depths of 320 feet below the water table, the air is compressed when it is released into the groundwater. The pressure upon release will be on the order of 140 to 180 psi (i.e. 10 to 13 atm). At these pressures the actual airflow will be approximately 30 acfm. As the air rises and the pressure declines, the air volume will increase in inverse proportion to the ratio of the initial pressure to the changing pressure. This phenomenon will lead to a reduction in aquifer permeability and a "damming-effect" – a decrease in the velocity of groundwater flow – can result. The more air forced in – and by most standards the volumes proposed are high for biosparging – the greater the effect on the permeability.
 - Another impact is more subtle, but somewhat more disastrous. Because the air is released under 10 atm of pressure, the saturation concentration of oxygen in the water is more than 10 times that under atmospheric pressure or in excess of 150 mg/l. That is good if more dissolved oxygen is needed, but is bad for any bacteria trying to survive at depth in the formation. The high oxygen concentration will poison the bacterial population. This effect will be reduced as the air rises and the pressure drops to a point where the DO

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can fall into a more reasonable range – less than 50 mg/l. This translates to a depth of less than 100 feet.

- When air is injected into the ground, it will rise along the path of least resistance to the water table. The geology at the site is heterogeneous due to its depositional history. As a result there are layers of variable permeability throughout the depth of the formation. This layering has some influence on groundwater flow, but has a much greater affect on airflow. This layering will lead to the preferential flow of the air along high permeability lenses horizontally. During pilot testing it is critical that the furthest monitoring wells be located at a minimum of 2 times the total injection depth to monitor this effect. In addition, the air can carry stripped VCM outward from the target groundwater zone, thus potentially spreading the VCM impacts both in the groundwater and in the vadose zone. Monitoring points should be included to track this effect and accurately define it.
 - VCM is a very volatile organic compound. At the proposed rates of air injection stripping of the VCM from groundwater will occur and could represent the chief mechanism of mass removal. Monitoring points should be added to track this effect and accurately define it. In addition, lower airflow rates should be tested to try to minimize this effect, although it is likely that the effect cannot be eliminated completely.
 - Finally, the rate of injection is higher than typical biosparge applications, which exacerbates all the effects described above. At a minimum lower rates should be tested and the proposed rate of 300 scfm should be seriously reconsidered.
7. The FS evaluation and cost projections summarized in the PRAP do not account for some of the issues described above. There are ways to overcome some of these issues (such as the use of blended gases -air plus nitrogen for example - to control the concentration of DO that can enter the groundwater) but at higher cost. Such considerations should be included in the cost comparison. At a minimum these issues and costs must be included in the pilot test program and in the subsequent data evaluation and full scale design and costing.
8. The PRAP includes a contingency for the addition of nitrogen and phosphorous to supplement the aerobic biodegradation of VCM in the groundwater. Given the fact that the groundwater is used for drinking water supplies in the area, the application of nutrients will require extensive permitting and monitoring.

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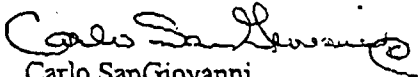
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9. The goal of the biosparge treatment system is to treat the VCM to a level that will ensure that there will be no need for supplemental treatment for VCM at the NGC treatment system. However, a VCM contingency plan should be developed to protect the NGC treatment plant from levels of untreated VCM that, if treated by the NGC plant, would result in exceedance of air discharge standards.
10. The PRAP recognizes that a portion of the chlorinated plume originating from the Ruco site is not addressed by the proposed remedy, but has been and continues to be treated by the NGC treatment system and the wellhead treatment systems provided for impacted public supply wells and funded by NGC and the Navy. It is clear that OCC should share the costs for these other treatment systems as well as the long-term O&M. Therefore, it is requested that the issue of cost recovery be addressed in the consent order to be issued to OCC for the RD/RA phase of the project.

If you have any questions please call us.

Sincerely,

ARCADIS Geraghty & Miller, Inc.



Carlo SanGiovanni
Project Manager



Michael F. Wolfert
Project Director

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